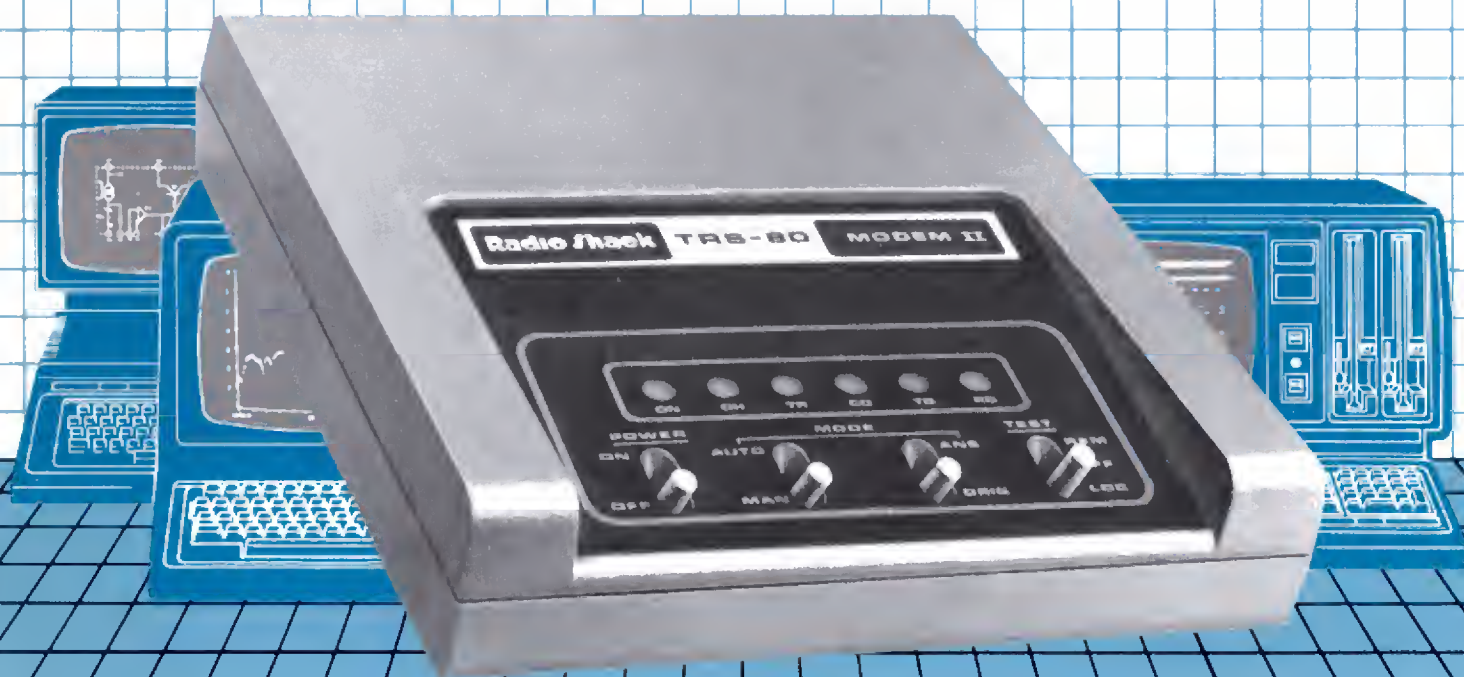


# TRS-80 Modem II

## OPERATION MANUAL

Catalog Number 26-1173



CUSTOM MANUFACTURED IN USA BY RADIO SHACK, A DIVISION OF TANDY CORPORATION

## **SERVICE POLICY**

Radio Shack's nationwide network of service facilities provides quick, convenient, and reliable repair services for all of its computer products, in most instances. Warranty service will be performed in accordance with Radio Shack's Limited Warranty. Non-warranty service will be provided at reasonable parts and labor costs.

Because of the sensitivity of computer equipment, and the problems which can result from improper servicing, the following limitations also apply to the services offered by Radio Shack:

1. If any of the warranty seals on any Radio Shack computer products are broken, Radio Shack reserves the right to refuse to service the equipment or to void any remaining warranty on the equipment.
2. If any Radio Shack computer equipment has been modified so that it is not within manufacturer's specifications, including, but not limited to, the installation of any non-Radio Shack parts, components, or replacement boards, then Radio Shack reserves the right to refuse to service the equipment, void any remaining warranty, remove and replace any non-Radio Shack part found in the equipment, and perform whatever modifications are necessary to return the equipment to original factory manufacturer's specifications.
3. The cost for the labor and parts required to return the Radio Shack computer equipment to original manufacturer's specifications will be charged to the customer in addition to the normal repair charge.

TERMS AND CONDITIONS OF SALE AND LICENSE OF RADIO SHACK COMPUTER EQUIPMENT AND SOFTWARE  
PURCHASED FROM A RADIO SHACK COMPANY-OWNED COMPUTER CENTER, RETAIL STORE OR FROM A  
RADIO SHACK FRANCHISEE OR DEALER AT ITS AUTHORIZED LOCATION

## LIMITED WARRANTY

### I. CUSTOMER OBLIGATIONS

- A CUSTOMER assumes full responsibility that this Radio Shack computer hardware purchased (the "Equipment"), and any copies of Radio Shack software included with the Equipment or licensed separately (the "Software") meets the specifications, capacity, capabilities, versatility, and other requirements of CUSTOMER
- B CUSTOMER assumes full responsibility for the condition and effectiveness of the operating environment in which the Equipment and Software are to function, and for its installation

### II. RADIO SHACK LIMITED WARRANTIES AND CONDITIONS OF SALE

- A For a period of ninety (90) calendar days from the date of the Radio Shack sales document received upon purchase of the Equipment, RADIO SHACK warrants to the original CUSTOMER that the Equipment and the medium upon which the Software is stored is free from manufacturing defects. THIS WARRANTY IS ONLY APPLICABLE TO PURCHASES OF RADIO SHACK EQUIPMENT BY THE ORIGINAL CUSTOMER FROM RADIO SHACK COMPANY-OWNED COMPUTER CENTERS, RETAIL STORES AND FROM RADIO SHACK FRANCHISEES AND DEALERS AT ITS AUTHORIZED LOCATION. The warranty is void if the Equipment's case or cabinet has been opened, or if the Equipment or Software has been subjected to improper or abnormal use. If a manufacturing defect is discovered during the stated warranty period, the defective Equipment must be returned to a Radio Shack Computer Center, a Radio Shack retail store, participating Radio Shack franchisee or Radio Shack dealer for repair, along with a copy of the sales document or lease agreement. The original CUSTOMER'S sole and exclusive remedy in the event of a defect is limited to the correction of the defect by repair, replacement, or refund of the purchase price, at RADIO SHACK'S election and sole expense. RADIO SHACK has no obligation to replace or repair expendable items.
- B RADIO SHACK makes no warranty as to the design, capability, capacity, or suitability for use of the Software, except as provided in this paragraph. Software is licensed on an "AS IS" basis, without warranty. The original CUSTOMER'S exclusive remedy, in the event of a Software manufacturing defect, is its repair or replacement within thirty (30) calendar days of the date of the Radio Shack sales document received upon license of the Software. The defective Software shall be returned to a Radio Shack Computer Center, a Radio Shack retail store, participating Radio Shack franchisee or Radio Shack dealer along with the sales document.
- C Except as provided herein no employee, agent, franchisee, dealer or other person is authorized to give any warranties of any nature on behalf of RADIO SHACK.
- D Except as provided herein, **RADIO SHACK MAKES NO WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**
- E Some states do not allow limitations on how long an implied warranty lasts, so the above limitation(s) may not apply to CUSTOMER.

### III. LIMITATION OF LIABILITY

- A EXCEPT AS PROVIDED HEREIN, RADIO SHACK SHALL HAVE NO LIABILITY OR RESPONSIBILITY TO CUSTOMER OR ANY OTHER PERSON OR ENTITY WITH RESPECT TO ANY LIABILITY, LOSS OR DAMAGE CAUSED OR ALLEGED TO BE CAUSED DIRECTLY OR INDIRECTLY BY "EQUIPMENT" OR "SOFTWARE" SOLD, LEASED, LICENSED OR FURNISHED BY RADIO SHACK, INCLUDING, BUT NOT LIMITED TO, ANY INTERRUPTION OF SERVICE, LOSS OF BUSINESS OR ANTICIPATORY PROFITS OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OR OPERATION OF THE "EQUIPMENT" OR "SOFTWARE". IN NO EVENT SHALL RADIO SHACK BE LIABLE FOR LOSS OF PROFITS, OR ANY INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF ANY BREACH OF THIS WARRANTY OR IN ANY MANNER ARISING OUT OF OR CONNECTED WITH THE SALE, LEASE, LICENSE, USE OR ANTICIPATED USE OF THE "EQUIPMENT" OR "SOFTWARE".  
NOTWITHSTANDING THE ABOVE LIMITATIONS AND WARRANTIES, RADIO SHACK'S LIABILITY HEREUNDER FOR DAMAGES INCURRED BY CUSTOMER OR OTHERS SHALL NOT EXCEED THE AMOUNT PAID BY CUSTOMER FOR THE PARTICULAR "EQUIPMENT" OR "SOFTWARE" INVOLVED.
- B RADIO SHACK shall not be liable for any damages caused by delay in delivering or furnishing Equipment and/or Software.
- C No action arising out of any claimed breach of this Warranty or transactions under this Warranty may be brought more than two (2) years after the cause of action has accrued or more than four (4) years after the date of the Radio Shack sales document for the Equipment or Software, whichever first occurs.
- D Some states do not allow the limitation or exclusion of incidental or consequential damages, so the above limitation(s) or exclusion(s) may not apply to CUSTOMER.

### IV. RADIO SHACK SOFTWARE LICENSE

RADIO SHACK grants to CUSTOMER a non-exclusive, paid-up license to use the RADIO SHACK Software on **one** computer, subject to the following provisions:

- A Except as otherwise provided in this Software License, applicable copyright laws shall apply to the Software.
- B Title to the medium on which the Software is recorded (cassette and/or diskette) or stored (ROM) is transferred to CUSTOMER, but not title to the Software.
- C CUSTOMER may use Software on one host computer and access that Software through one or more terminals if the Software permits this function.
- D CUSTOMER shall not use, make, manufacture, or reproduce copies of Software except for use on **one** computer and as is specifically provided in this Software License. Customer is expressly prohibited from disassembling the Software.
- E CUSTOMER is permitted to make additional copies of the Software **only** for backup or archival purposes or if additional copies are required in the operation of **one** computer with the Software, but only to the extent the Software allows a backup copy to be made. However, for TRSOOS Software, CUSTOMER is permitted to make a limited number of additional copies for CUSTOMER'S own use.
- F CUSTOMER may resell or distribute unmodified copies of the Software provided CUSTOMER has purchased one copy of the Software for each one sold or distributed. The provisions of this Software License shall also be applicable to third parties receiving copies of the Software from CUSTOMER.
- G All copyright notices shall be retained on all copies of the Software.

### V. APPLICABILITY OF WARRANTY

- A The terms and conditions of this Warranty are applicable as between RADIO SHACK and CUSTOMER to either a sale of the Equipment and/or Software License to CUSTOMER or to a transaction whereby RADIO SHACK sells or conveys such Equipment to a third party for lease to CUSTOMER.
- B The limitations of liability and Warranty provisions herein shall inure to the benefit of RADIO SHACK, the author, owner and/or licensor of the Software and any manufacturer of the Equipment sold by RADIO SHACK.

### VI. STATE LAW RIGHTS

The warranties granted herein give the **original** CUSTOMER specific legal rights, and the **original** CUSTOMER may have other rights which vary from state to state.

## Important Note

Before connecting your Modem II to the phone lines, notify your local telephone company of the:

**Manufacturer:** Radio Shack

**Model:** Modem II, #26-1173

**USOC Number:** RJ11C

**FCC Number:** AAO88U-68616-DM-E

**Ringer Equivalence Number (REN):** 0.7B

You can also find this information on the bottom of your modem.

Do not connect your Modem II to:

- ☒ Party-line phones
- ☒ Coin-operated phones

***TRS-80® Modem II Operation Manual* © 1982 Tandy Corporation, Fort Worth, Texas 76102  
U.S.A. All Rights Reserved.**

Reproduction or use, without express written permission from Tandy Corporation, of any portion of this manual is prohibited. While reasonable efforts have been taken in the preparation of this manual to assure its accuracy, Tandy Corporation assumes no liability resulting from any errors or omissions in this manual, or from the use of the information obtained herein.

# Contents

Introduction .....	1
1/Description of the Modem II.....	3
2/Setting Up the Modem II.....	5
Connecting the Modem II to a Telephone	
Connecting the Modem II to a Power Supply	
Connecting the Modem II to a Computer	
3/Using the Modem II with Videotex Software .....	9
4/Technical and Programming Information.....	15
5/Troubleshooting and Maintenance .....	23
Test Mode	
6/Specifications .....	25
Appendix A/How Quickly Does the Modem II Dial? .....	27
Appendix B/Modem II Programming Commands.....	29
Appendix C/Operational Flow Chart .....	31

---

## Notes

# Introduction

With a TRS-80® Modem II your computer or data terminal can communicate with other computers or terminals via ordinary telephone lines.

The Modem II was designed to work with any TRS-80 computer or data terminal that has RS-232-C capabilities. This includes TRS-80:

- Model I
- Model II
- Model III
- Model 16
- Color Computer
- DT-1 Data Terminal

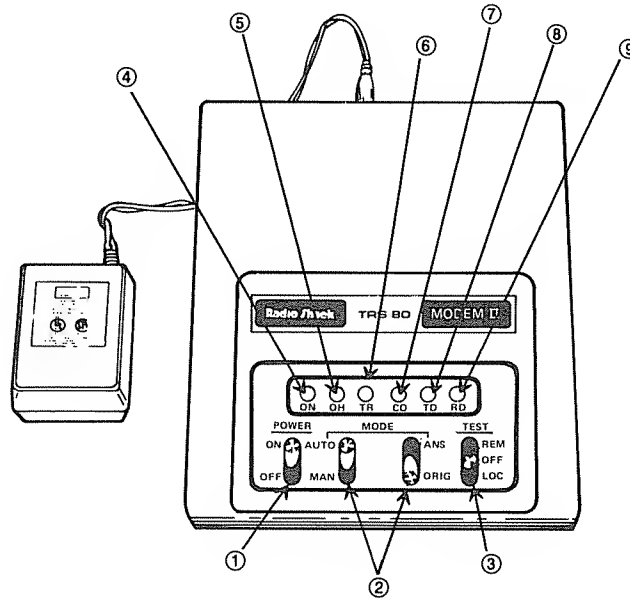
You'll need some software — any program containing RS-232 drivers and receivers will work. Your local Radio Shack Computer Store has several suitable programs, such as Videotex, Terminal, and the Color Computer Videotex Program Pak.

---

# Notes

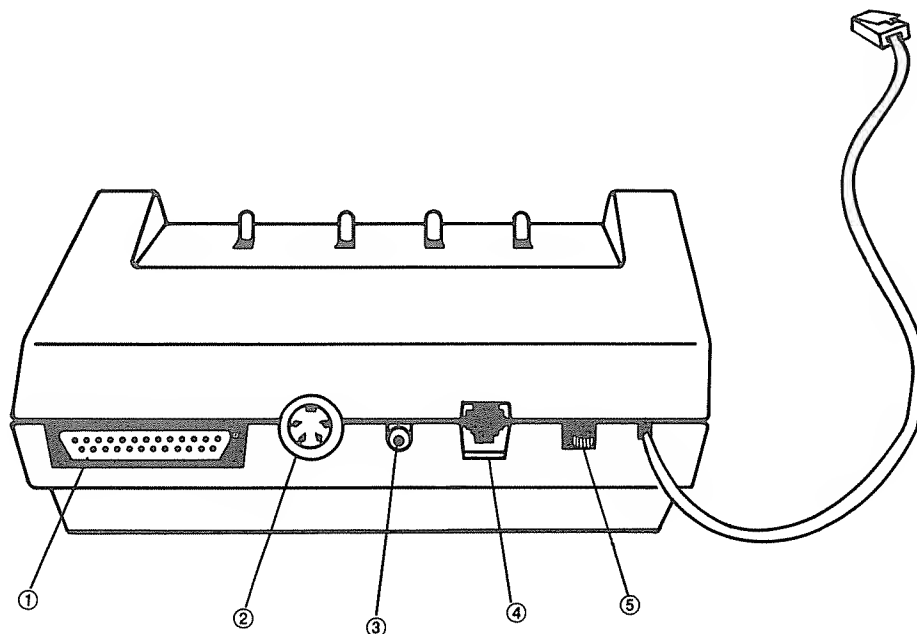


# 1/Description of the Modem II



**Figure 1. Modem II (Top View)**

- ① **POWER Switch** turns your Modem ON or OFF. Be sure to turn your Modem OFF when you're not using it.
- ② **MODE Switches** selects four modes of operation: AUTO ANswer, AUTO ORIGINate, MANual ANSwer, and MANual ORIGINate.
- ③ **TEST Switch** selects LOCal Test Mode, REMote Test Mode, or turns Test Mode OFF.
- ④ **ON (Power) Light** is on when power is ON.
- ⑤ **OH (Off-Hook) Light** is on when your Modem has control of the phone line.
- ⑥ **TR (Terminal Ready) Light** is on when the RS-232 control line, DTR (Data Terminal Ready), is on.
- ⑦ **CD (Carrier Detect) Light** is on while your Modem is receiving a "carrier tone."
- ⑧ **TD (Transmit Data) Light** flashes when your Modem is transmitting information.
- ⑨ **RD (Received Data) Light** flashes when your Modem is receiving information.



**Figure 2. Modem II (Rear View)**

- ① **RS-232-C** Standard DB-25 jack for connection to RS-232-C Interface of TRS-80 Models I, II, and III, and 16.
- ② **RS-232** Four-pin DIN jack for connection to the Serial I/O (RS-232) of the TRS-80 Color Computer.
- ③ **PWR** Jack for the AC adapter plug.
- ④ **PHONE** Jack for modular-type telephone line cords.
- ⑤ **FORCE DTR Switch** forces Data Terminal Ready (DTR) and Carrier Detect (CD) on. When using a Color Computer, set this switch to ON. When using other computers, the setting of this switch depends upon how you program your Modem.

## 2/Setting Up the Modem II

Set your Modem's POWER Switch to OFF before connecting anything!

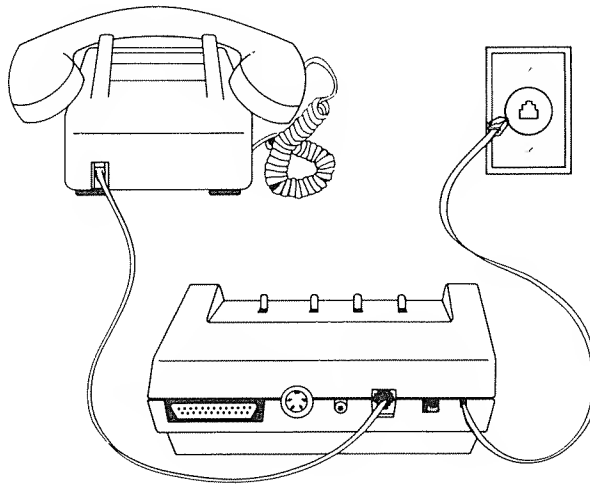
There are three steps to setting up your modem. Each step is fully explained in this section.

- Connect your Modem II to your telephone.
- Connect your Modem II to a power supply.
- Connect your Modem II to a computer.

### Connecting the Telephone to the Modem II

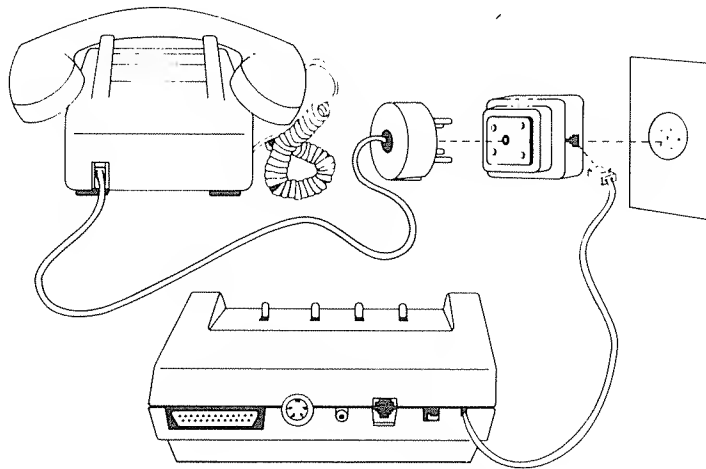
The way you connect the Modem II to a telephone depends on how your telephone is connected to the wall. The following three figures illustrate these connections.

If you're using your Modem II outside the USA, you may need a Modular-to-Modular Cable (Radio Shack Catalog Number 279-374) and a Duplex Modular Jack (279-357).



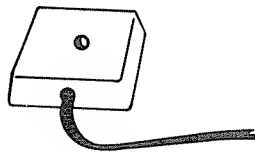
**Figure 3. Modular Connector**

If your telephone has this type of connection, attach your Modem II as shown. (If you plan on using the Modem in AUTOMATIC Modes only, you don't need to use a telephone.)



**Figure 4. Four-Prong Connector**

If your telephone has the older style, four-prong connection, use an adapter (279-360) to connect it to your Modem II as shown.



**Figure 5. Wall Connector**

If your telephone is wired directly to the wall, contact your telephone company.

## Connecting the Modem II to Multi-Line Telephones

You can use your Modem II with a multi-line telephone. However, you may need a Multi-Line Adaptor (such as Radio Shack Catalog Number 43-270/271), a hardware modification to the Modem II, or both.

If you use a Multi-Line Adaptor *only*, the HOLD Button on an extension phone can interfere with communication if someone presses it. To avoid this problem, have a qualified Radio Shack Service Technician modify the Modem II.

For other Adaptors which may be used, contact your Radio Shack store.

## Connecting the Power Supply to the Modem II

Insert the AC adapter into the AC Power jack on the back of the modem. Plug the adapter into an electrical wall outlet.

Use the supplied, UL-listed adapter only. The use of any other adapter could damage the modem.

## Connecting the Computer to the Modem II

The Computer you connect to the Modem II must have RS-232-C capabilities.

Table 1 summarizes the cable and connection requirements for RS-232-C equipped TRS-80's. Table 2 provides quick instructions on RS-232-C connection points on TRS-80 computers. For more detailed instructions, see your Computer's owner's manual.

Modem-to-Computer Cables	
TRS-80	Cable Catalog #
Model I	26-1145*
Model II/16	26-4403
Model III/DT-1	26-1408
Color Computer	26-3014

**Table 1**

\*The Model I RS-232-C cable is supplied with the RS-232-C Interface Board (26-1145). See your Radio Shack Computer Center for details.

Computer RS-232-C Location	
TRS-80	Location
Model I	Front of the Expansion Interface
Model II/16	Rear of the Computer
Model III/DT-1	Underneath the Computer
Color Computer	Rear of the Computer

**Table 2**

To connect the Modem II to the Computer:

1. Be sure the Computer and modem's power are OFF.
2. Plug the appropriate end of the connecting cable into the modem's RS-232 jack.
3. Plug the other end of the cable into the Computer's RS-232-C jack.
4. Power up the System as described in your Computer's owner's manual.

- 
- When you're not using the Modem, turn it OFF! If you don't, you won't be able to use your telephone for normal conversation.
  - When you use your Modem for the first time or when you seem to be getting garbled data, use the Modem's two test Modes — REMote and LOCAl — to help you find the cause of the problem.
  - Be sure to always sign-off when communications are finished. The sign-off message depends on the computer that receives the phone call — BYE or GOODBYE are commonly used.
  - Because of a pre-set feature of the Modem II, the phone will ring twice in Automatic Mode. To change the number of rings, a Radio Shack Service Technician can modify the Modem II.

Note to Color Computer Users: Always set your Modem's FORCE DTR Switch ON.

---

## 3/Using the Modem II with Videotex Software

A Modem that is connected to a Computer running a TRS-80 Videotex software package constitutes one of the most common (and exciting!) ways to use your Modem II. This section will describe how to use the Modem II with VIDTEX (the Videotex program) on TRS-80 Model I, II, III, and Color Computers.

If you're interested in writing your own programs for the Modem II, refer to the section of this manual entitled **Technical and Programming Information**. It will give you a detailed account of how the Modem II works but on a technical level.

### Manual vs. Automatic Operation

If you want to dial an information service (such as CompuServe or Dow Jones) or communicate with another person whose computer is also using VIDTEX, you can set the appropriate MODE Switch to MAN (manual). In this mode, *you* control what the System does by "manually" dialing and answering the phone.

If you want the modem to dial a phone number (or answer the phone) for you, set the appropriate MODE Switch to AUTO (automatic). In this mode, the *Modem* dials the phone number you specify or answers the phone when someone calls you. Automatic Mode, for instance, lets you dial the information service number without picking up the phone — just type the number (along with the proper Modem II programming commands) on the Computer keyboard. (In other words, let your fingers do the walking — but on the keyboard instead of the telephone!)

### Originate vs. Answer Modes

If *you want to place a call* (to an information service or another person using VIDTEX), set the other MODE Switch to ORIGinate. In this mode, the call "originates" from *your* computer.

If *you want to receive a call* (e.g., "answer" the phone), set the appropriate MODE Switch to ANSwer.

Note that Originate and Answer Modes can be used either manually or automatically. That is, you can set the MODE Switches to MAN/ORIG, MAN/ANS, AUTO/ORIG, or AUTO/ANS depending on your particular needs.

During communication, you can also change the MODE Switch settings without interfering with communications. When you disconnect from the information service, however, the Modem will automatically go to the "new" mode. For example, if the MODE Switches are set to MAN/ORIG (the most common setting when communicating with an information service) and you want to switch to AUTO/ANS on disconnect, just change the settings before you sign off. The Modem II will begin waiting for a call and automatically answer the phone *after* it disconnects from the service.

If you set the TEST Switch to REMote while communicating with an information service, the Modem will simulate half-duplex communication and the Host system may send you "double-characters."

## Videotex and the Modem II

Videotex software packages that allow you to communicate with an information service or with other Videotex users over the phone, are available for TRS-80 Models I, II, III, and Color Computers. For specific details on using an information service once you've established communications, refer to your information service user's guide.

Color Computer users should always remember to set the FORCE DTR Switch to ON. We suggest that other TRS-80 users also keep the FORCE DTR set to ON unless your program explicitly calls for FORCE DTR to be OFF.

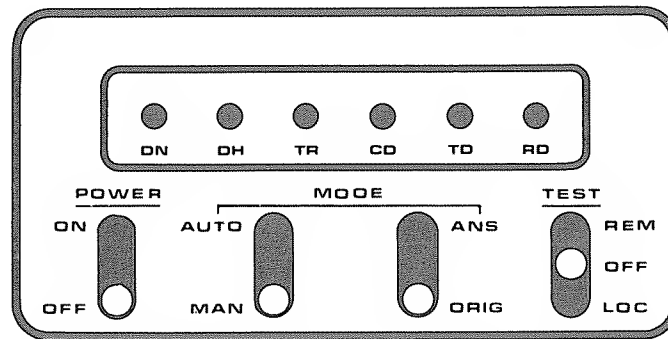
## MANual/ORIGinate Operation

The most common (and probably the easiest) method of calling an information service is when the MODE Switches are set to MANual and ORIGinate.

In this mode, you'll need to be next to the Modem and Computer when you are using Videotex (e.g., "attended use"). Once the program is loaded, *you* must dial the information service and begin communication.

To use the Modem II in MANual/ORIGinate Mode, follow these steps:

1. Set the FORCE DTR Switch (on the back of the modem) to ON.
2. Be sure the switches on the front of the modem are set to the following:



3. Load the VIDTEX program as described in your **Videotex User's Guide**.
4. Pick up the telephone receiver and dial the information service phone number.
5. When the information service answers the phone, you will hear a *high-pitched* tone.
6. Set the Modem's POWER Switch to ON. The RD light will then come on.

Next, the CD light will illuminate and, after a two second delay, the RD light will go off.

At the same time, you'll hear a *low-pitch* tone.

7. Gently hang up the phone.

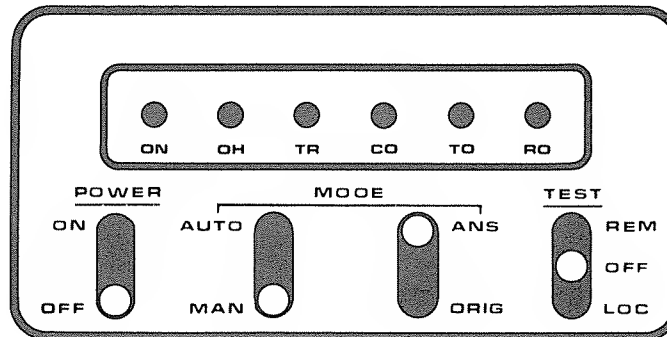
You can then begin following the instructions detailed in your Videotex and information service user's guide.



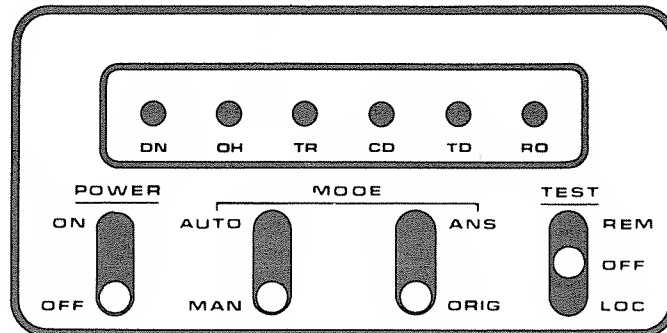
## MANual/ANSwer Mode

If you wish to use VIDTEX to communicate with another person who is also using VIDTEX and a Modem II, one of you will have to set the MODE Switches to MAN and ORIG (Manual/Originate Mode) and the other person will have to set the switch to MAN and ANS (Manual/Answer Mode). Although it is up to you and the person you're communicating with to decide who is to be ORIG and who is to be ANS, we suggest the following sequence:

1. Be sure the FORCE DTR Switch on both Modem II's are set to ON.
2. Both you and the other person should load VIDTEX.
3. The other person should set the Modem II switches to:



4. You should set your Modem II switches to:



5. You should dial the other person's phone number.
6. When *the other person's phone* rings, he/she should pick up the receiver.
7. The other person should set the Modem POWER Switch to ON.

Then *both* of you will hear a high-pitched tone and the Modem's RD lights will come on.

8. Next you should set your Modem's POWER Switch to ON.

Both CD lights will illuminate and, after a 2 second delay, the RD lights will go off.

At the same time, you both will hear a low-pitch tone.

9. Both you and the other person should *gently* hang up the phones.

You can then begin communicating with the other person simply by typing on your computer's keyboards. Your messages will be displayed on the other person's Screen and vice versa. If you wish to see what you type displayed on your Screen (and vice versa), set your Modem's Test Switch to REM. If the other person also sets his/her Modem's Test Switch to REM, you will not be able to communicate. Remember! Only one REMote Test Switch on at a time!

## Automatic Mode

Automatic Mode Operation allows you to leave your Modem and Computer “unattended” and the Modem II will automatically dial or answer the phone.

This is useful for many reasons, foremost among them being the Modem II automatically can dial numbers at night when the phone rates are cheaper, transfer information to another computer, and then hang-up the phone.

The Modem II has both AUTO/ANSwer (for answering) and AUTO/ORIGinate (for dialing).

## AUTO/ANSwer Mode Operation

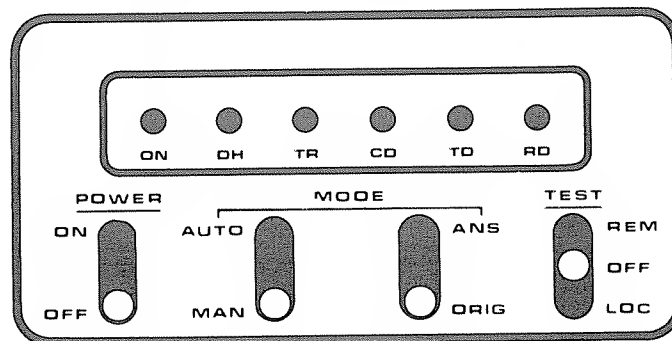
AUTO/ANSwer Mode can be used in conjunction with MANual dialing or AUTOMATIC dialing.

For example, if you and another person wish to communicate using VIDTEX and you’ve previously decided on who will be ORIGINating the call and who will be ANSwering it, you may want to use AUTO/ANS.

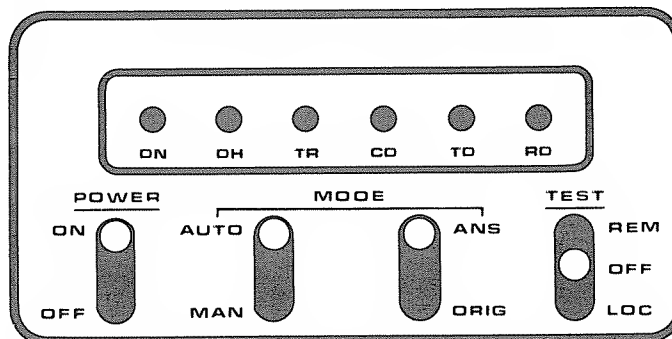
In the following example, *you* will AUTO/ANSwer the phone; *the other person* will MANually ORIGINate (dial) the phone.

To use AUTO/ANS:

1. Be sure both Modem II’s FORCE DTR Switches are set to ON.
2. The other person should set his/her Modem Switches to:



3. Set your Modem switches to:



(Be sure your POWER Switch is set to ON!)

4. *The other person* should dial your phone number. When your phone rings, *do not pick up the receiver!* After one or two rings, the Modem should seize the phone lines (and ON, OH, and TR Lights should go ON).

5. When the other person hears the high-pitched tone, he/she should set the Modem II POWER Switch to ON.
6. When the other person hears a low-pitch tone, he/she should hang-up the phone.

You can then begin communicating with each other by typing on your computer's keyboards.

## AUTO/ORIGinate Mode Operation

Automatic dialing requires that you use programs that have drivers and receivers or write your own program to dial a phone number. Programs that successfully fulfill your needs can sometimes become quite complicated. If you want to write AUTO/ORIGinate programs, carefully read the section of this manual entitled **Technical and Programming Information** and refer to the Appendixes.

To use the Modem II in AUTO/ORIGinate Mode under VIDTEX:

1. Set the Modem's FORCE DTR Switch to ON.
2. Enter programming mode (send an \*). The TR Light will illuminate and the \* will echo on the Screen.
3. Type a Modem command and phone number. Press X to dial the number.
4. Begin communications when the CD Light comes ON.

The Modem II remembers program data until you change modes or turn the POWER OFF.

## Hints and Tips on Automatic Operation . . .

- The Modem II *always* checks the front panel switch settings on power-up and after a disconnect.
- Test Mode (when the TEST Switch is set to either LOCal or REMote) has priority over all other switches. That is if you set the MODE Switches and then the TEST Switch, the Modem II will always run the Test.
- If you program the Modem in Automatic Mode, the software commands will "override" the front panel switches only once. After that first override, the action of the Modem will be based on the switch settings. To override again, you must go into programming mode and re-execute the Modem II program.
- You can change the switch settings during communications without interruption. However, if you set the TEST Switch to REMote, the Modem will simulate half-duplex and (if the Host isn't using half-duplex) your Video Screen will display double-characters. If you are communicating with another person and both of you set the TEST Switch to REM, communication will end.

See **Technical and Programming Information** and **Appendix B** for details on "unattended use" of the Modem II.

## Simulating Half-Duplex

To simulate half-duplex mode, set the Test Switch to REM after making contact with another computer. If your display shows two characters for every character you type, you should not be simulating half duplex — set your TEST Switch to OFF and proceed as usual.

---

# Notes

## 4/Technical and Programming Information

The Modem II accepts data from a computer, converts that data into tones and then sends the tones over telephone lines to another modem. It also accepts tones from telephone lines and changes those tones into data that your computer understands.

The following criteria must be met before computer-to-computer communication can take place.

- Both computers must have the same communication protocol:

- ☒ Baud Rate (0-300)
- ☒ Word Length
- ☒ Parity
- ☒ Number of Stop Bits

See your Computer owner's manual to find out how to set communication protocol.

- One Modem must be in the ORIGINate Mode and the other must be in the ANSWer Mode. Usually, if you call another computer, you should be in the ORIGINate Mode. If you receive a call, you should be in the ANSWer Mode.
- If you're using a Modem II with a TRS-80 Color Computer, always keep the FORCE DTR Switch (on the back of your Modem) ON.

### Space Disconnect

Your Modem will drop the phone line any time it receives a continuous RS-232 SPACE (ASCII BREAK or null with no start and stop bits) for three seconds from the remote modem or for 1.5 seconds from your Computer. This is called "space disconnect" and is in accordance with Bell 103J standards for short and long space disconnect. In all modes except TEST, your Modem will disconnect itself from the phone lines if it receives a loss of carrier greater than 300 milliseconds.

To regain control over your Modem after it receives a Space Disconnect while in the MANUAL Mode, switch to AUTOMATIC Mode or turn the POWER Switch to OFF. Then reset the Modem switches as desired. If your Modem receives a Space Disconnect while in the AUTOMATIC Mode, the Modem will execute the front panel switches.

When you use your Modem II in AUTOMATIC Mode, you don't have to dial any numbers or pick up your telephone receiver to answer a call — your Modem does all that for you. As long as you're going to be at your Computer throughout communications, you can control the Modem — and your telephone — through your Computer keyboard. This is another easy way to run certain communications programs such as Videotex.

You can also send or receive data from another computer while you're not at your Computer keyboard. Just write a BASIC or machine-language program and use the commands described in this manual (See Appendix B) to program your Modem to dial a number or answer the phone unattended. By programming your Modem to download daily receipts to another computer at

12:00 midnight, for example, you'll save time and be able to take advantage of lower telephone rates. When programming, be sure to use the following protocol:

Modem II Programming Protocol
8 Data Bits
No Parity
300 Baud
1 Stop Bit
Uppercase only

Table 1

## A Brief Overview of Modem II Commands

When programming your modem, enter only one character at a time. Do not attempt to type (or send) the "next" character until the "current" character is echoed. Your Modem will either echo the character you send (display it on the Screen if you're using Videotex) or send an error symbol (? or N), indicating that you sent an invalid command. Occasionally your Modem will neither echo the character you sent nor send an error message (a question mark). When this happens, just send the character again (this usually occurs only when sending an \*).

Remember! Type in all commands as capital letters. The Modem II doesn't recognize lowercase letters. These commands are explained in more detail in Appendix B.

Modem II Programming Commands	
Command	Function
*	Opens modem for programming.
C	Clears (resets) modem memory.
D	Clears current telephone number from memory. Must precede any new telephone number.
F	Fast rotary dialing (20 pps).
L	Transmits (displays) current contents of modem memory to the computer (terminal).
P	Inserts a two-second pause in dialing sequence.
Q	Puts modem into LOCal Test Mode.
R	Rotary dialing (default value).
S	Slow rotary dialing (10 pps) (default value)
T	Tone dialing (10 digits per second).
X	Executes current program (dials phone number in memory).

Table 2

Before programming, be sure to use the correct protocol (see Table 1) and be sure that the Computer you intend to communicate with is using the same protocol.

## Modem II Programming Mode

The Modem II contains a custom 8-bit microprocessor which has user memory that allows the Modem to dial a number which can be up to 25 digits in length. The Modem may dial the number from either AUTO/ORIGinate or AUTO/ANSwer Mode.

Before programming the Modem, you must put it in programming mode. You can do this two ways:

- Setting FORCE DTR to ON and then sending an asterisk (\*) to the Modem.
- Setting FORCE DTR to OFF and then sending an asterisk (\*) or disasserting (turning off) DTR from the Computer or Terminal.

## When can you program the Modem II?

When the Modem is in AUTOMATIC Mode and an "idle state," it can be programmed.

An idle state is defined as:

- The Modem is in AUTO Mode and not in Test Mode.
- The Modem is not connected to the phone line (OH Light is off).
- The Modem is not in the process of answering a call.
- DTR is asserted (turned on) by the Computer or by the FORCE DTR Switch.

The idle state occurs if the appropriate MODE Switch is set to AUTO when the power is turned on or after the Modem has received a disconnect (loss of carrier or SPACE) while in AUTO Mode.

## The FORCE DTR Switch

The main purpose for the FORCE DTR Switch is to allow the Modem II to be used with the TRS-80 Color Computer. The Color Computer does not have DTR (Data Terminal Ready) as an RS-232 control line. Also, some other terminals which use a three-wire RS-232 scheme (ground, data in, and data out) could not be used with the Modem.

The Modem II uses the DTR line as its master control line. In all operation modes, DTR must be asserted to cause the internal microprocessor to execute its program. Here are the rules for DTR:

- The Modem will not execute the front panel switch settings until DTR is on if DTR is off during power-up.
- The Modem will immediately drop carrier and disconnect from the phone line if DTR is off while the Modem is on-line with another modem. After a three second delay, the Modem II will be in programming mode (if the front panel switches are in AUTO Mode and DTR is still OFF) or go into a "sit" mode if the Modem is in MANUAL Mode.
- The Modem will execute the front panel switches if DTR is reasserted after the Modem has disconnected from the phone lines.

---

## The Internal Modem Program

The Modem II's internal program is ROM based. (See the **Operational Flowchart** in **Appendix C** for details on program execution.) The program is based on receiving two elements:

- The RS-232 control DTR.
- ASCII text strings.

These text strings must be sent in a certain format when the Modem is in programming mode. The strings may be sent using BASIC, FORTRAN, assembly-language, VIDTEX, or any other software which has RS-232 drivers/receivers.

The UART's of TRS-80 Computers and Data Terminals must have carrier detect asserted at their end to allow data transfer. However, the Modem does not usually assert carrier detect until it receives carrier from another modem. Therefore, the Modem asserts carrier to the Computer at selected times. If the FORCE DTR switch is set to ON, carrier detect is always forced to the Computer. The Computer software never knows when the Modem has been disconnected from the phone line by examination of the carrier detect bit in the UART status register.

If the Computer software requires carrier detect to signal loss of carrier, the FORCE DTR Switch must be set to OFF. However, you must realize that carrier detect is controlled by the internal microprocessor and close attention must be paid between the Modem II forcing carrier (to allow the text strings to be sent) and the actual carrier detect resulting from another modem.

## Modem II Carrier Detect Protocol

The following discussion refers to AUTO/ORIGinate Mode only. (In the Manual Modes, the microprocessor does not force carrier. Therefore, the carrier detect the Computer sees is the true carrier.)

In AUTO/ORIGinate Mode, the Modem forces carrier (not the true carrier) when:

- The Modem is in an idle state and AUTO/ORIG.
- The Modem is in programming mode.
- The time from entry into programming mode until two seconds after the number has been dialed. After the two second delay, the Modem releases the forced carrier detect and the CD line to the Computer is off. When the true carrier is detected, the CD line will go on again.
- During LOCal Test.

There are several considerations concerning this protocol. For instance:

*How long does it take the Modem to dial?* For details, see **Appendix A**.

*What if another modem answers the phone before the two seconds are up?* If this happens, the "other" modem is not conforming to Bell 103J standards for auto-answer modems and we do not support such cases.

The Modem II does not force carrier in the idle state of the AUTO/ANSwer Mode. However, the Modem will dial out and go to the Originate Mode if properly programmed. This is called "override" and needs to be explained in detail.

When the Modem II was designed, compromises were made between how much functionality could be packed into the ROM (it's only 1K!) and ease of programming. The override feature is useful since you can have one modem do the job of two — the Modem II can be switched in software to AUTO/ORIGinate even though the switches are set to AUTO/ANSwer and the Modem may be 200 feet away in a locked closet.



If your Computer requires carrier detect before data can be transmitted, the Computer software must be written so that instead of polling carrier detect, it must rely on a scheme independent of carrier detect. This is most easily solved by the remote sending a carriage return or some other code to tell it when it has connected. This requires the remote user to begin communications. In fact, there is little software difference to polling the UART status register as opposed to polling the UART holding buffer.

Once a remote connection has been detected when the Modem is in the AUTO/ANSWER Mode with carrier forced by the FORCE DTR Switch, it is necessary to detect a disconnect as well. The Computer software must rely on the remote user to type a sign-off code (such as GOODBYE, etc.) since loss of carrier can't be used. This would tell the Computer software user to drop the carrier. If he/she does so, the Modem II will detect loss of user carrier and drop the phone line connection. After a three second delay, the Modem will go back to the state set by the front panel switches.

If the remote user is using a Modem II and types a sign-off message but leaves the Modem on, you can turn his Modem off through the use of a long space disconnect. To do this, simply instruct the UART to send a SPACE disconnect (no start or stop bits) and the following will happen:

- The host Modem II will drop carrier after receiving a 1.5 second SPACE and drop the phone line.
- The remote Modem II will drop the phone line when it sees loss of host carrier.

This technique will also work if the host is a Modem I. In this case, the remote Modem II will drop the line after reception of a SPACE of three seconds.

## Modem II Timing Protocol

The Modem II has several software timers implemented in its program. These timers are used for various reasons and are fairly accurate since the microprocessor's clock is crystal controlled. The **Operational Flowchart** (see **Appendix C**) should be studied if the Modem is to be used for unattended operation. Table 3 describes the Modem II timers:

Modem II Software Timers	
Time	Function
6 seconds	The 6 second timer is used for a "warm start" condition. It is invoked when power is applied.
3 seconds	The 3 second timer is used for a disconnect timer. After receiving a disconnect, the Modem drops the phone line and delays three seconds before executing the front panel switches
2 seconds	The 2 second timer is the Bell 103J standard. The delay is set from the time the Modem seizes the phone line to the time it transmits carrier. This is used in all modes.
12 seconds	There is a 12 second delay from when the Modem transmits carrier to disconnect if remote carrier is not detected.
33 ms.	This is the time to transmit a character to or from the Modem II (10 bits at 300 baud). Also, the delay time for the echo hand-shaking scheme used to program the Modem.

Table 3

---

## How To Program the Modem II

The Modem II can be used in two general ways:

- Attended use, in which a Modem II is connected to a Computer which is constantly being used by a person.
- Unattended use, in which the Modem II is connected to a Computer which is maintained by software and an operator is not present.

A good example of attended use is a TRS-80 Model III running VIDTEX software to access an information service (such as CompuServe or Dow Jones). In this instance, you type on the keyboard and VIDTEX transmits, receives, and echoes the characters to and from the Modem. When the session is over, you turn the Modem off.

An example of unattended use might be an auto parts dealer who writes an assembly-language program for his TRS-80 Model 16. The program might dial the home office computer at 2:00 A.M. when the phone rates are cheaper. Daily reports could then be downloaded.

As far as the Modem II is concerned, there are no real differences between attended and unattended use. However, attended use tends to mask subtle timing restraints (humans are slow) so timing is important to correctly program the Modem.

For unattended use, VIDTEX is unsuitable. This is because there is not an operator present to type on the keyboard and no one to read the Screen for information that must be responded to. Therefore, you must write different routines to program the Modem to dial and to turn the Modem off when the session is over.

The first thing to do is to place the Modem in programming mode. This can be done two ways, depending on the setting of the FORCE DTR Switch:

- If the Switch is ON, an asterisk (\*) must be sent.
- If the Switch is OFF, either send an asterisk (\*) or drop DTR.

If the Modem is in programming mode (remember, it must be in an idle state first), the TR Light will go off. For attended use, this signals you that all entries typed from the Computer will be interpreted as Modem programming commands. Since you will not be there for unattended use, there must be another way to signify programming mode. This is done by character echo hand-shaking.

The Modem's microprocessor constantly monitors the incoming data from the Computer. When the Modem is in programming mode, this data is examined for syntax errors. If an error occurs, the Modem transmits a question mark (?). If the data is a valid command or data string, it is transmitted back to the Computer at 300 baud.

Therefore, to program the Modem II, follow these steps:

1. Enter the programming mode.

If an \* is used, the Modem may not accept the *first* time because of interrupt handling. When the programming mode is entered, the \* will be sent to the Computer. Therefore, the Computer program must be set up to send an \* until there is an echo back from the Modem.

2. Send one character (such as a character in a phone number) to the Modem at a time.

This means you must wait until a character is echoed back before sending the next character. This is necessary because the Modem's interrupt stack would overflow causing loss of data.

3. There is a time delay required between the time the character echo is received and the next character is sent. This time must be a minimum of 33 ms.
4. After all characters have been sent, the Modem will wait until DTR is asserted before it will execute the program and dial the number.

After the Modem has dialed the number, it forces carrier detect for two seconds — then releases it. This time period allows the receiver filters to stabilize from the impedance change presented by the phone line. The Modem then waits for carrier from the remote modem for a period of 12 seconds. If carrier is detected, the Modem asserts carrier detect to the Computer. If carrier is not detected, the Modem drops the phone line and, after a three second delay, executes the front panel switches.

The Modem override (from AUTO/ANS to AUTO/ORIG) is programmed by entering the programming mode, sending a number to dial, and executing by asserting DTR. The Modem will internally switch filter banks and transmit/receive frequencies under microprocessor control. It will then act exactly as if the Modem was in AUTO/ORIG Mode. After a disconnect, it will go back to AUTO/ANS Mode. The override program is still intact as long as power is applied. If further overrides are necessary, place the Modem in programming mode and either re-program the phone number or send an X and assert DTR.

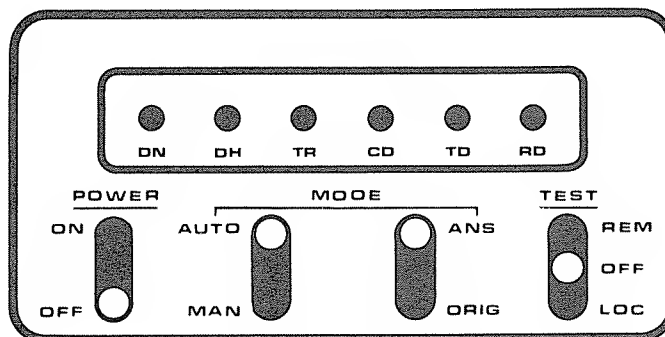
See **Appendix B** for a complete explanation of the Modem programming codes.

## AUTO/ANSwer Operation

Another unattended use of the Modem II is in an AUTO/ANSwer environment. The Modem is easy to use in this mode.

To use the Modem II in AUTO/ANSwer Mode:

1. Set the MODE Switches to:



2. Assert DTR (by the Computer or by the FORCE DTR Switch).
3. Set the Modem's POWER Switch to ON.

The ON and TR Lights will go on.

After the phone rings, the Modem seizes the line, delays for two seconds, and transmits carrier. It then waits 12 seconds for the remote modem to send carrier. If it does not see the remote carrier, it disconnects from the phone line, delays three seconds, and goes back to AUTO/ANSwer Mode and waits for the next call.

There may be some instances when it is desirable to tell the Modem not to answer an incoming call or to hang up on a call in progress. This is done by either turning FORCE DTR OFF or by placing the Modem in the LOCAL Test Mode. This is only practical if FORCE DTR is off since the only way to get out of a LOCAL Test (programmed by the Q command) is to set the Modem's FORCE DTR to OFF. The LOCAL Test resets the ring detect circuitry inside the Modem so incoming rings are ignored.

---

## Notes

## 5/ Troubleshooting and Maintenance

If you have trouble transmitting data (garbled data, intermittent errors, etc.) be sure that:

- The phone connection is clean and noise-free.
- No one is talking on the telephone line.
- The phone and all extensions are on-the-hook.
- The baud rate of the terminals is less than or equal to 300.

If you still can't locate the source of your problem, run the LOCal Test (and the REMote Test, too, if necessary).

### Error Messages

- ? Your Modem has received a character which isn't in proper order or which it doesn't understand.
- N Error in dialing. The Modem isn't programmed properly. This usually means that you instructed your Modem to dial, but it doesn't have a telephone number in its register. Press C and start again.

### Test Mode Operation

If you have communication problems, first check all your connections and cables!

If neither you nor the person you're communicating with locate a connection or cable problem, run the LOCal Test (both computers should run this test). If both Modems pass the LOCal Test, run the REMote Test together. If both systems pass the REMote Test, and you're still having problems with data transfer, contact your nearest Radio Shack Computer Center.

### LOCal Test

The LOCal Test checks your modem's filters, power supply and circuitry. If one of the modems fails the LOCal Test, isolate the problem and solve it. The most common cause of failure is a damaged cable or improper connection.

1. Set your Modem's POWER Switch to ON.
2. Set the TEST Switch to LOC (since the Modem II always runs the Test first, you can have the Mode Switches set to any combination). The modem's CD light will come on.
3. Type some letters and/or numbers on your Computer's keyboard. If what you type is displayed on your Screen, your Modem has passed the LOCal Test. If the characters are not displayed, the Modem has failed the test.
4. If your Modem failed the LOCal Test (the typed characters did not appear on your screen), check the cables and connections. Then run the test again. If both modems pass the LOCal Test and the problem persists, run the REMote test.

### To get out of the Test Mode. . .

How you get out of the Test Mode depends on how you got into it. In the MANual Mode, just set your Modem's POWER Switch to OFF or set the TEST Switch to OFF. If you're in the AUTOMATIC Mode and got into the Test Mode by typing QX, set FORCE DTR to OFF and then back to ON. Your Modem will then execute according to the Mode Switches.

---

## REMOte Test

If both of the modems pass the LOCAL Test and data transmission is still inaccurate, run the REMote Test. This test loops the RS-232 data from the modem receiver to the driver. In doing so, it checks the operation of the modems, terminals, and phone connections. You'll need the cooperation of another person who is using a modem.

1. Establish communication with the other person.
2. The other person should set his/her TEST Switch to REM (if they are using a Modem II).
3. Set your TEST Switch to OFF.
4. Type some letters and/or numbers on your keyboard. If the characters are displayed first on the other Video Display and then on your Display, both systems have passed the REMote Test. Repeat the test, reversing the switches and having the other person type, just to be sure.

If the characters don't appear on both screens, both you and the other person should repeat the LOCAL test. If the LOCAL Test does not detect any problems, but the system still doesn't pass the REMote Test, you've probably got phone line problems. If the situation persists, contact your phone company.

## 6/ Specifications

### Receive Frequencies

A. Answer  
Mark 1270 Hz  
Space 1070 Hz

B. Originate  
Mark 2225 Hz  
Space 2025 Hz

### Transmit Frequencies

A. Answer  
Mark 2225 Hz  
Space 2025 Hz

B. Originate  
Mark 1270 Hz  
Space 1070 Hz

### Transmit Level

-10 dBm +/- 1 dB

### Receive Sensitivity

-40 dBm

### Baud Rate

0 — 300

### Operating Temperature

55 F — 85 F  
(13C — 29 C)

### Electrical Requirements

15 VAC @ 600ma  
supplied by UL listed  
adapter

### Size

6.5" x 7.5" x 2"  
(16.5 x 19.1 x 5.1 cm)

### Operating Modes

Manual Answer  
Manual Originate  
Auto Answer  
Auto Originate

### Test Modes

Local Loopback  
Remote Loopback

---

## Notes



## Appendix A/ How Quickly Does Your Modem Dial?

Rotary Dialing			
Number being dialed	Number of pulses	Number being dialed	Number of pulses
1	1	6	6
2	2	7	7
3	3	8	8
4	4	9	9
5	5	0	10

Fast rotary dialing: 20 pulses per second.  
0.4-second pause after each number.  
Slow rotary dialing: 10 pulses per second.  
0.8-second pause after each number.

### Example

235-8214

Fast rotary dialing

Number of pulses:  $2 + 3 + 5 + 8 + 2 + 1 + 4 = 25$  pulses

Dialing time:  $25 \text{ pulses} / 20 \text{ pulses per second} = 1.25 \text{ second}$

Pauses:  $0.4 \text{ seconds} \times 7 \text{ numbers} = 2.8 \text{ seconds}$

Remember to add 2 seconds for each P command!

Total time:  $1.25 \text{ seconds} + 2.8 \text{ seconds} = 4.05 \text{ seconds}$

Slow rotary dialing

Number of pulses:  $2 + 3 + 5 + 8 + 2 + 1 + 4 = 25$  pulses

Dialing time:  $25 \text{ pulses} / 10 \text{ pulses per second} = 2.5 \text{ seconds}$

Pauses:  $0.8 \text{ seconds} \times 7 \text{ numbers} = 5.6 \text{ seconds}$

Total time:  $2.5 \text{ seconds} + 5.6 \text{ seconds} = 8.1 \text{ seconds}$

### Tone Dialing

Tone dialing: 10 characters per second

### Example

235-8214

$7 \text{ characters} / 10 \text{ characters per second} = .7 \text{ seconds}$

Remember to add 2 seconds for each P command!

---

## Notes

# Appendix B/ Modem II Programming Commands

Type all commands in uppercase only! Your Modem doesn't recognize lowercase letters.

**\***

## **Opens the Modem II for programming.**

You must use \* when your Modem's FORCE DTR Switch is ON. If Force DTR is OFF, you have the option of sending \* or turning DTR OFF. Occasionally, your Modem might not recognize the asterisk and you may have to send two asterisks. This usually happens after the Modem has disconnected from the phone lines and has been reset.

**C**

## **Clear (reset) memory.**

C clears your Modem's memory and resets the Modem to its default values: 10 pps rotary dialing (R and S commands). There'll be a six-second delay before this happens and, if your FORCE DTR Switch is OFF, a loss of carrier will result. There's no need to type X after this command.

**D**

## **Dial register access.**

D clears the current telephone number from memory and must precede any new telephone number.

**F**

## **Fast rotary dialing (20 pps).**

If you don't specify how you want your Modem to dial the number, it will dial rotary-style at 10 pulses per second. This command changes the dialing speed to 20 pulses per second. Before using this command, contact your local telephone business office to check whether your telephone exchange can use 20pps dialing.

**L**

## **Look.**

L sends the current contents of your Modem's memory to the local terminal at 300 baud, using the format *Dnnts/* where:

D = Dial Register

*nnn* = telephone number and any pauses (P)

*t* = R (rotary type dialing) or T (tone type dialing)

*s* = F (20 pps) or S (10 pps)

/ = end of file

U = Undefined (a blank in the dial register)

There's no need to use X with this command.

**P**

## **Pause.**

Inserts a two-second pause in the dialing sequence. This command is especially useful when you're dialing from a business system that requires an outside access code. For longer pauses, use more than one P.

**Q**

## **Local Loopback Test.**

This command puts your Modem into the same mode as the LOCAL Test Switch and allows you to perform a LOCAL Test.

**R**

**Rotary dialing.**

Dials rotary-style at 10 or 20 pulses per second. Default.

**S**

**Slow rotary dialing (10 pps).**

10 pulses per second rotary dialing (default).

**T**

**Tone dialing.**

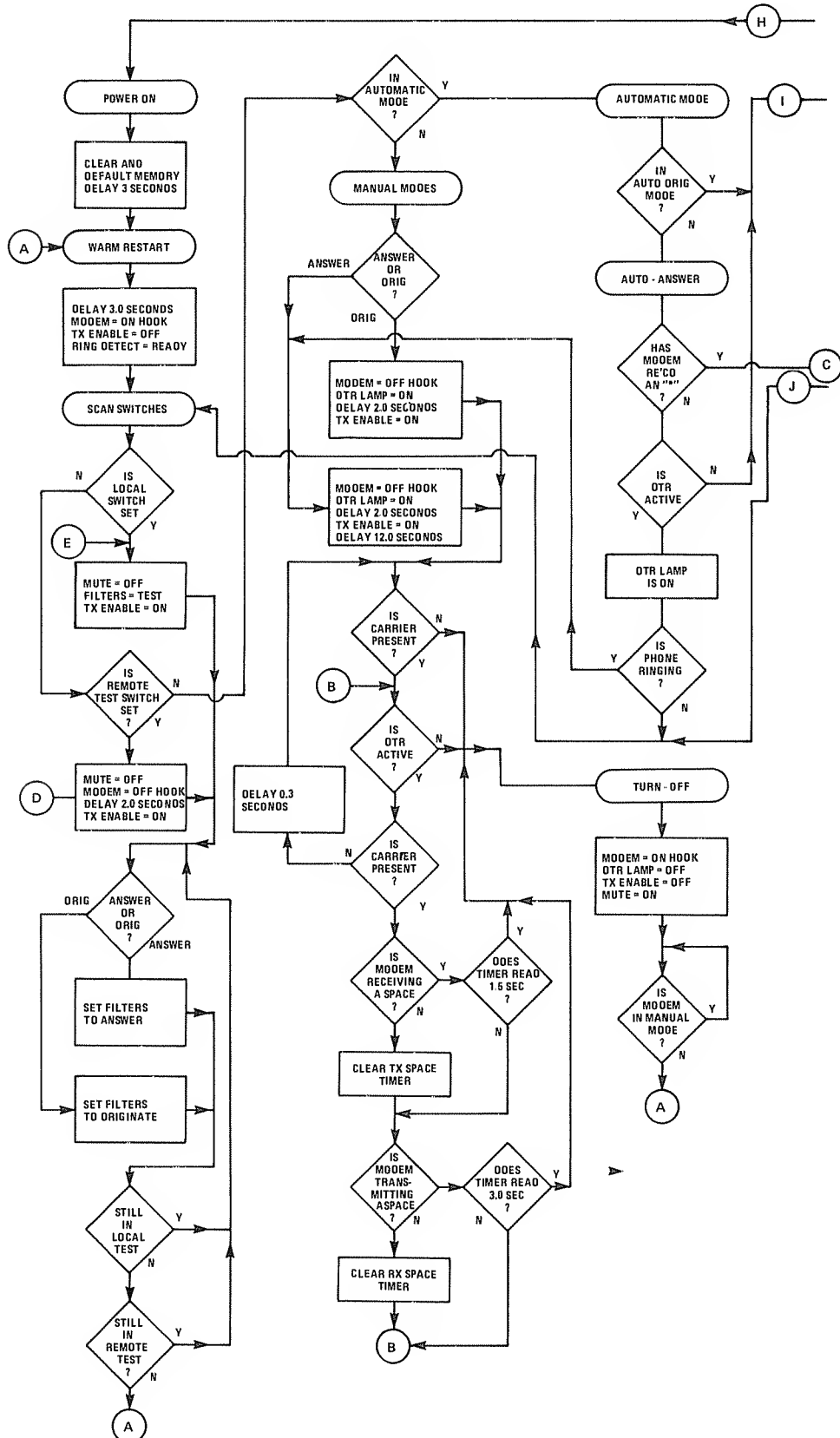
Dials at 10 digits per second.

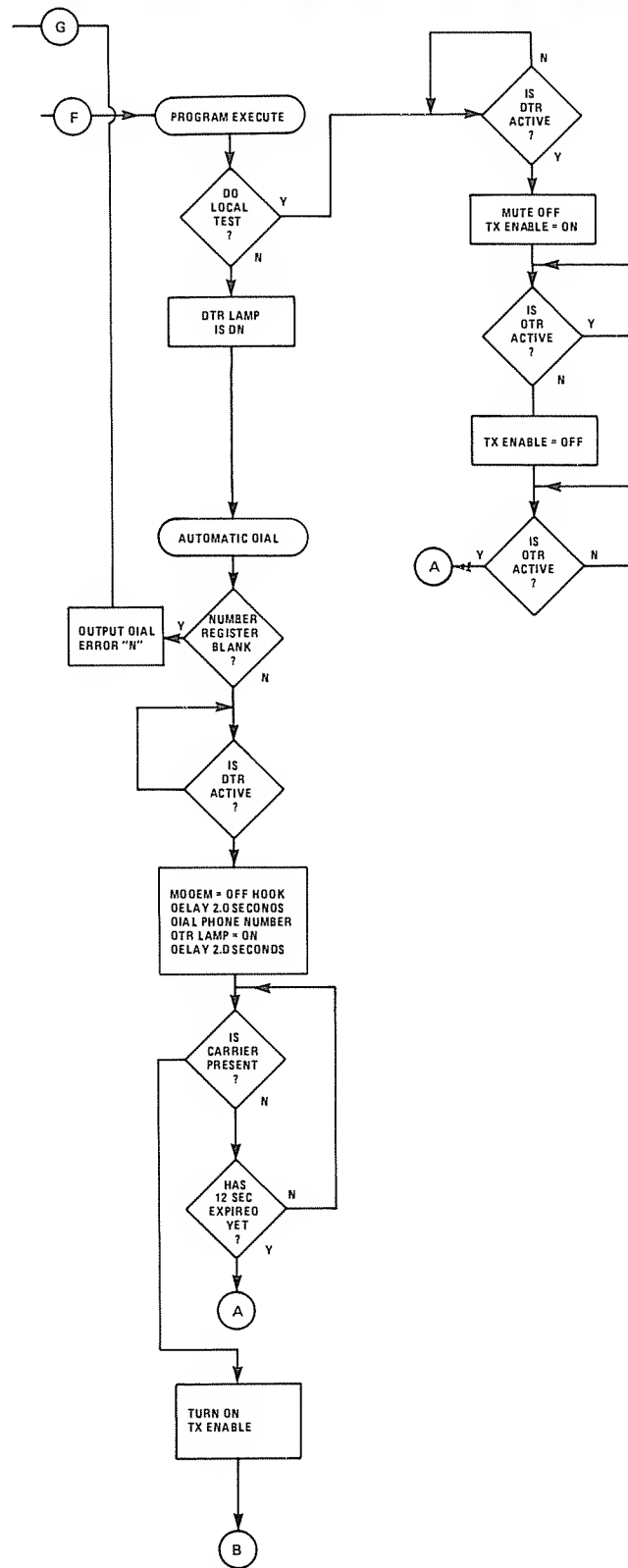
**X**

**Execute.**

If your modem's FORCE DTR Switch is ON, send it an X and it will immediately execute the program presently in its memory. If your modem's Force DTR Switch is OFF, it will execute the program presently in its memory only after you send it an X and then reassert DTR.

## Appendix C/Operational Flowchart





**RADIO SHACK, A DIVISION OF TANDY CORPORATION**

**U.S.A.: FORT WORTH, TEXAS 76102**

**CANADA: BARRIE, ONTARIO L4M 4W5**

---

**TANDY CORPORATION**

---

**AUSTRALIA**

91 KURRAJONG ROAD  
MOUNT ORUITT, N.S.W. 2770

---

**BELGIUM**

PARC INDUSTRIEL DE NANINNE  
5140 NANINNE

---

**U. K**

BILSTON ROAD WEDNESBURY  
WEST MIOLANOS WS10 7JN